1264554

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

December 20, 2004

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE.

APPLICATION NUMBER: *60/518,076*
FILING DATE: *November 07, 2003*
RELATED PCT APPLICATION NUMBER: *PCT/US04/37257*

Certified by

Jon W Dudas

Acting Under Secretary of Commerce
for Intellectual Property
and Acting Director of the U.S.
Patent and Trademark Office

PTO/SB/16 (10-01)
Approved for use through 10/31/2002. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

Express Mail Label No.	EV 327682969 US

INVENTOR(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
G. Michael Jerry L.	Pope Green	N. Ft. Myers, FL Joliet, IL

☐ *Additional inventors are being named on the _____ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

A DEVICE FOR REMOVING PARTICULATE, VARIOUS ACIDS, AND OTHER CONTAMINANTS FROM INDUSTRIAL EXHAUST GASES

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

☒ Customer Number 23446
Type Customer Number here

OR

☐ Firm *or* Individual Name					
Address					
Address					
City		State		Zip	
Country		Telephone		Fax	

ENCLOSED APPLICATION PARTS *(check all that apply)*

☒ Specification *Number of Pages* 6
☒ Drawing(s) *Number of Sheets* 2
☐ Application Data Sheet. See 37 CFR 1.76
☐ CD(s) *Number* ____
☒ Other (specify) Return Receipt Postcard

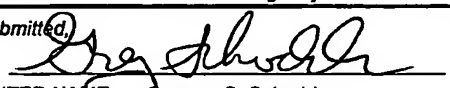
METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

☒ Applicant claims small entity status. See 37 CFR 1.27.
☒ A check or money order is enclosed to cover the filing fees
☒ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 13-0017
☐ Payment by credit card. Form PTO-2038 is attached.

FILING FEE AMOUNT($) 80.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.
☐ Yes, the name of the U.S. Government agency and the Government contract number are: ____

Respectfully submitted,
SIGNATURE 
TYPED or PRINTED NAME Gregory C. Schodde
TELEPHONE (312) 775-8000

Date November 7, 2003
REGISTRATION NO. *(if appropriate)* 36,668
Docket Number: 15297US01

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is used by the public to file (and by the PTO to process) a provisional application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the complete provisional application to the PTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Washington, D.C. 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop Provisional Patent Application, Commissioner for Patents, P.O. Box 1450 Alexandria, VA. 22313-1450.

"Express Mail" mailing label number EV 327682969 US

Date of Deposit: November 7, 2003

Attorney Docket No.1848/15297US01

A DEVICE FOR REMOVING PARTICULATE, VARIOUS ACIDS, AND OTHER CONTAMINANTS FROM INDUSTRIAL EXHAUST GASES

RELATED APPLICATIONS

[0001] [Not Applicable]

FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] [Not Applicable]

[MICROFICHE/COPYRIGHT REFERENCE]

[0003] [Not Applicable]

BACKGROUND OF THE INVENTION

[0004] This process involves bubbling the exhaust air from various fixed site industrial processes up through one or more columnar vessels containing an appropriate brine solution, the exact composition of which to be determined by the contaminants to be removed from the subject exhaust air stream.

[0005] The system is primarily designed to clean exhaust gases from fixed site sources such as internal combustion engines, boilers, incinerators, pyrolysis systems or waste gasifiers, dryers, paint booths, or other such sources of air pollution. The invention is especially useful for cleaning exhaust gases requiring compliance with EPA criteria limits for particulate (dust), SO_2 and HCl emissions.

[0006] This method is more efficient than wet scrubbers or electrostatic precipitators in removing particulate, acids, and other chemical contaminants because of increased retention time of the subject exhaust's exposure to the water and/or solution media, enhanced surface area of contact with the water and/or solution media with the subject exhaust gases as they are infused in micro-bubble size through the brine solution in the column, and significantly increased turbulence of the gases with the water and/or solution media. Further, the exposure

of the incoming gas to the column will also aid in reducing the gas temperature, thereby reducing the final gas volume. The smaller the volume of the exhaust gas, the smaller and more economical the down stream piping and air handling equipment needs to be.

BRIEF SUMMARY OF THE INVENTION

[0007] The column is a vertical tank (made of fiberglass, plastic, or metal) of varying diameters and heights. The total volume of the column being modified to accommodate the throughput of gas from the production source at a flow rate which provides adequate retention time (from 4 to 10 seconds) in the brine solution. For example, a column with a three (3) foot diameter and a height of ten (10) feet may accommodate small gas exhaust streams from 1,000 to 3,000 cubic feet per minute (cfm). Larger volume exhaust streams could require one or more columns of ten (10) feet in diameter and sixty (60) feet in height. The column could be made of metal, but fiberglass/plastic offers the best resistance to acidic or caustic corrosion over time.

[0008] A column is the most effective geometry for this water vessel. The taller the column of water, the longer the time required for the bubbles to rise to the surface, thereby increasing the reaction time for the gases to interact with the brine solution.

[0009] The described column is an enclosed tank with an air inlet in the base for injecting the subject gases, a drain tap at the bottom for releasing water from the column, a water fill inlet for make-up water, and an exit port at the top of the tank where the decontaminated gases collect and are removed from the column. The tank will also be fitted with an inspection port or site glass at approximately six (6) feet above ground level on the side of the column.

[0010] There may be more than one column depending on the composition of the exhaust gas to be treated (as discussed in the following technical analysis). A single pass through the column filled with fresh water would be sufficient for most dust or particulate control applications. The addition of caustic soda or other neutralizing agents to the fresh water would extract from the passing exhaust air significant amounts of entrained HCl, SO_2, or other acids.

[0011] The exhaust gases from the referenced systems are forced through an air stone made of either alumina, wood or silica. This diffuser stone is installed in the base of the water

column described above and is similar to the type of stone found in aquariums. The air stone diffuser breaks the incoming gas up into micro-fine bubbles (optimally 0.5 to 1.0 mm in diameter) which increases the surface area of the gas, thus improving its exposure to the brine solution in the column. Further, the smaller the bubbles formed, the lesser the surface tension of the bubble and the greater the reactivity with the bubble's gas and the surrounding brine solution.

[0012] The exhaust gases from the industrial process will be propelled with sufficient force into the diffuser by a fan, compressor, venturi, eductor, or aspirator.

[0013] The column may also be filled with plastic aeration balls (Bio-pins) of varying diameters suspended in the brine solution, depending on the specific retention/transit time desired for the gas flowing through the column. These plastic spheres slow the rate of the gas bubbles rising to the surface of the column, thus increasing retention time as well as turbulence of the air and brine mix, thereby improving the potential for chemical reactions. As an example, the column may be filled to 70% of its total height with aeration balls.

[0014] Above the surface level of the brine solution in the column is a fine mist spray assembly. This pipe and nozzle array recycles brine solution from the column and sprays it as a fine mist on the surface of the brine in the column. The purpose of this mist is to further provide points of contact between the exhaust gases rising from the bursting bubbles in the column with the brine mist. This provides a final additional point of contact for chemical reaction prior to the release of the gas from the column.

[0015] Once the air bubbles reach the top of the column, an induced draft fan, eductor, aspirator, or compressor vents off the treated and cooled gases, and diverts them for further processing or appropriate discharge to the atmosphere.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

[0016] [Not Applicable]

DETAILED DESCRIPTION OF THE INVENTION

[0017] The following is a description of the test vessel design. Each treatment column would be individually sized (scaled) to meet the particular needs for each type of exhaust product. The sizing criteria is based on the type of industrial process, the flow rate and

column of the exhaust gas, the particulate (entrained solids) load, and the specific chemical contaminants to be removed.

[0018] Fresh water itself is extremely effective in trapping any solid particles entrained in the exhaust gas, and removing any water soluble acids from the gas stream (such as HCl or SO_2).

[0019] The presence of brine in the water column is also effective in providing uptake of Carbon Dioxide (CO_2), and provides absorption through chemical reaction with other contaminants in the exhaust gas. In the case of acid removal, adding a base such as caustic soda or lime will effectively neutralize the acid. For example, hydrochloric acid dissolved in the brine will react with the base to form a salt. For optimum effect, the specific gravity of the brine solution should be 1.015 and 1.025 as measured by hydrometer. Optimum pH is from 8.0 to 8.5.

[0020] Calcium Hydroxide ($Ca(OH)_2$), Calcium Carbonate ($CaCO_3$), and/or Sodium Bicarbonate ($NaHCO_3$) can also be mixed with the column water to absorb other acids found in some industrial exhaust gases.

[0021] This process is significantly less expensive to construct and operate than conventional wet scrubbers. Further, there is a major reduction in the daily water consumption of such a gas processor. Power requirements to percolate exhaust gas through the water column in the way described are far less than atomizing chemical mixtures in a wet scrubber system.

CLAIMS

1. A pollution control device comprising a water-tight container, wherein the container has an inlet port at a lower portion of the container, an exhaust port at an upper portion of the container, said exhaust port located above the fluid level in said container, and a gas containing pollutants is forced into the inlet portion to form a bubble stream; and said bubble stream is drawn out of said container through said exhaust port.

ABSTRACT OF THE DISCLOSURE

[0022] [Not Applicable]

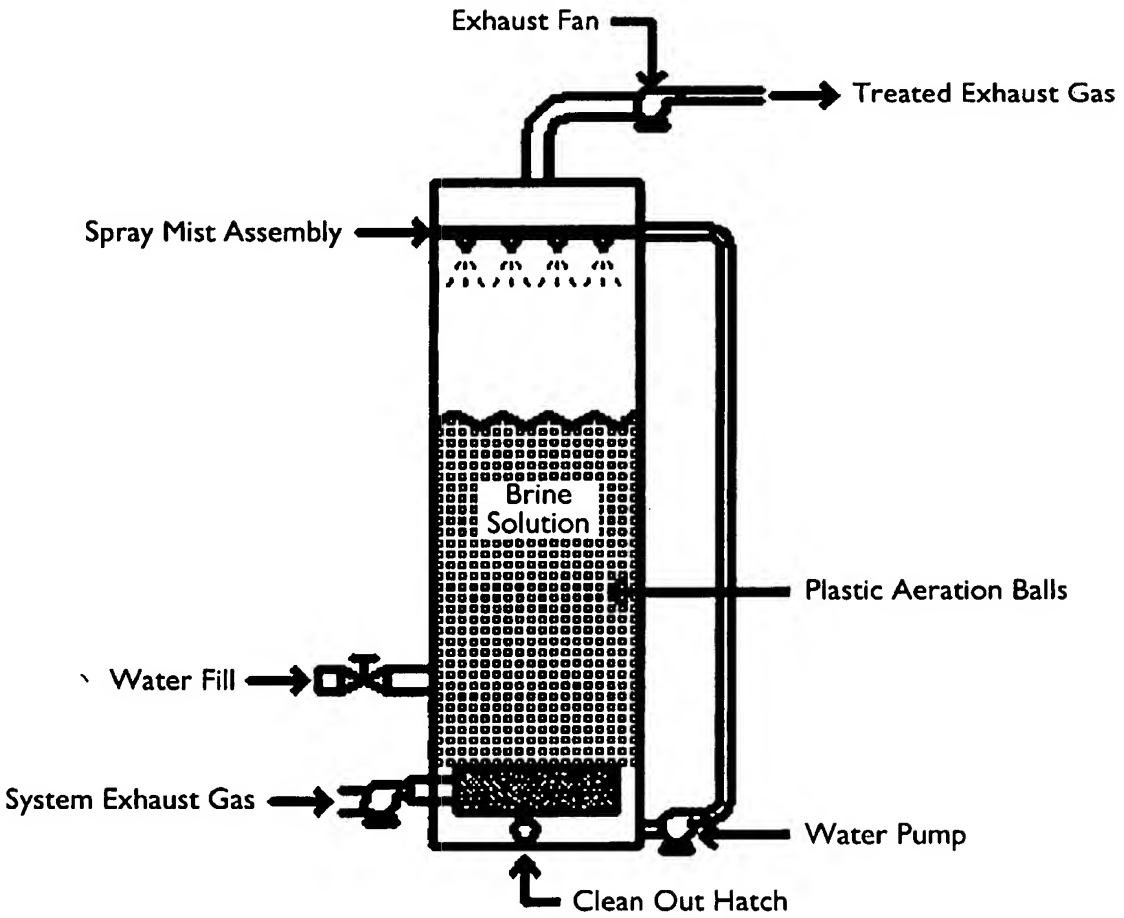
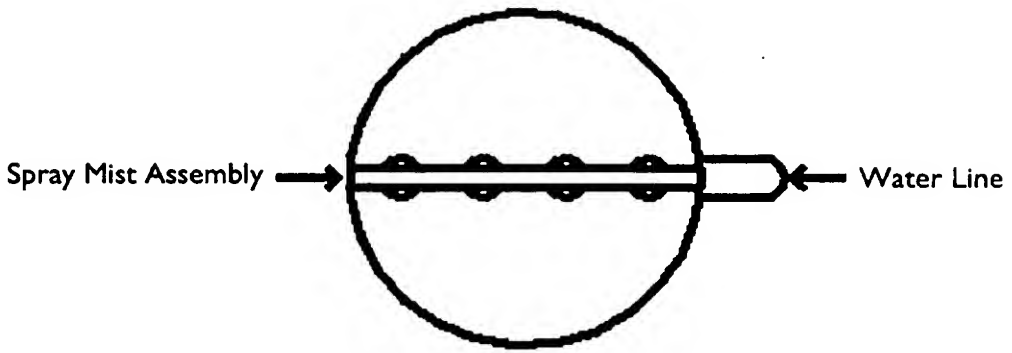
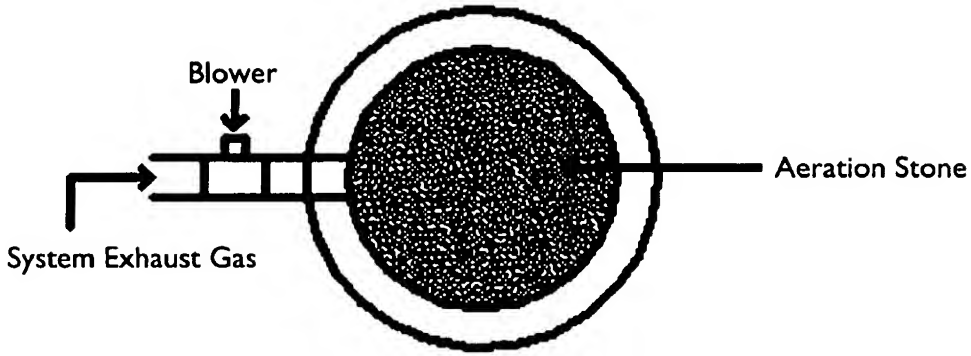


Figure 1. Water Column Elevation View
SenreQ LLC



Cross Section A to A1 from Figure 1



Cross Section B to B1 from Figure 1

Figure 2. Column Cross Section
SenreQ LLC

Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/US04/037257

International filing date: 08 November 2004 (08.11.2004)

Document type: Certified copy of priority document

Document details: Country/Office: US
Number: 60/518,076
Filing date: 07 November 2003 (07.11.2003)

Date of receipt at the International Bureau: 05 January 2005 (05.01.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

World Intellectual Property Organization (WIPO) - Geneva, Switzerland
Organisation Mondiale de la Propriété Intellectuelle (OMPI) - Genève, Suisse